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TITLE: Control system for transmissions

DATE-ISSUED: January 30, 2001

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FIELD-OF-SEARCH: 701/55, 701/96, 701/53, 701/70, 701/95, 701/200, 180/179, 180/170

PRIOR-ART-DISCLOSED:

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Search Selected Search ALL Clear

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ART-UNIT: 361

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ABSTRACT:

A control system for an automatic transmission includes a route information detector which detects route information for the vehicle and a transmission which is controlled by the route information detector. The control system also includes a device for detecting the places where it is necessary to decrease speed in the determined traveling distance, a device for calculating the vehicle target speed for each corner, a device for calculating the required vehicle speed at the present position of the vehicle to decrease present vehicle speed to the vehicle target speed for the place where it is necessary to decrease speed.. And if the target deceleration from the present speed to the required vehicle speeds lager than a threshold value, the place is regarded as the target place, and it is counted as the target place, and the automatic transmission is shifted down.

16 Claims, 10 Drawing figures

L10: Entry 7 of 10 File: USPT Jan 30, 2001

DOCUMENT-IDENTIFIER: US 6182000 B1
**** See image for Certificate of Correction ****
TITLE: Control system for transmissions

Abstract Text (1):
A control system for an automatic transmission includes a route information detector which detects route information for the vehicle and a transmission which is controlled by the route information detector. The control system also includes a device for detecting the places where it is necessary to decrease speed in the determined traveling distance, a device for calculating the vehicle target speed for each corner, a device for calculating the required vehicle speed at the present position of the vehicle to decrease present vehicle speed to the vehicle target speed for the place where it is necessary to decrease speed. And if the target deceleration from the present speed to the required vehicle speeds lager than a threshold value, the place is regarded as the target place, and it is counted as the target place, and the automatic transmission is shifted down.

Application Filing Date (1):
19971217

Brief Summary Text (3):
This invention is directed to a control device for an automatic transmission, which has plural and non-continuous gear stages, is controlled based on the information regarding the road condition of the route that the vehicle follows. This information is output by a route information detection device.

Brief Summary Text (5):
Generally, the gear stage of an automatic transmission for a vehicle is automatically controlled by the driving condition of the vehicle, which is detected by various sensors. Although if sensors are used to detect the vehicle driving condition, they can only detect the change of the vehicle driving condition when the vehicle encounters an actual change in road conditions. So, if sensors are used, the driving force is changed by shifting the gear stages after detection of an actual change in the driving condition, which sometimes reduces the drivability and performance of the vehicle. Recently, it has become possible for a route information detection system, for example, a navigation system, to detect in advance information regarding the road condition, on which the vehicle travels, and this information is used to control shifting of the gear stages of an automatic transmission before the road conditions actually change. An example of a vehicle control system is disclosed in Japanese Patent Laid Open Publication No. HEI 7-306998.

Brief Summary Text (7):
Regarding the automatically controlled transmission, in addition to the continuously variable transmission (CVT), there is so a called automatic transmission which has plural and non continuous gear stages, consisting of the gear mechanisms and frictional engagement units. The gear stages are non continuous gear ratios, the gear stages are set by engaging one frictional engagement unit and disengaging another frictional engagement unit. When the gear stage of the automatic transmission changed, the frictional engagement units will engage or

disengage, which causes shift shock during a shift change.

Brief Summary Text (8):
A vehicle, that has an automatic transmission, with non continuous gear stages, to go through a curve smoothly, should be controlled by decreasing its speed before the curve. It is also desirable to avoid changing the speed ratio during the curve. Although for a vehicle that has an automatic transmission, if the gear stage is changed from a higher stage to a lower stage to decrease the vehicle speed, it is possible that more than one shift changing will continuously occur, and consequently the shift shock of the gear shift changing will occur as well. That's why if the above mentioned invention is applied the same to a vehicle that has automatic transmission, it is impossible to prevent the occurrence of the shock of the speed changing.

Brief Summary Text (10):
One object of the present invention is to provide an automatic transmission control system that is able to decrease the number of gear stage shifts as much as possible, when the vehicle, goes through a curve. A control system built according to the present invention is described in the following. The traveling distance to zero the vehicle is determined if the vehicle decreases its speed from the present speed by the predetermined decreasing speed. The number of corners, which are regarded as the places where it is necessary to decrease speed, are detected in the determined traveling distance. The vehicle target speed Vt is calculated for each corner. Vt is set for maintaining proper behavior of the vehicle, stability of operation, and good drivability if the vehicle rounds the corner. The required vehicle speed Vi at the present position of the vehicle calculated to decrease present vehicle speed V to the vehicle target speed Vt for the specific corner. Vi is calculated on the basis of the distance between the present position of the vehicle and each corner. The target deceleration from the present speed V to the required vehicle speed Vi of the specific corner is lager than the threshold value, the specific corner is regarded as the target corner It, and it is counted as the target corner It. The target corner needs the automatic transmission 2 to shift down.

Brief Summary Text (12):
According to the invention, when the corner is detected on the road ahead of the present position by the navigation system, the gear stage is shifted down only if the deceleration from the present vehicle speed to the required vehicle speed Vi is more than the threshold value. The shifting down of the gear stage is aimed towards getting engine brake effect easily. So it is possible that when the criteria are satisfied, the automatic transmission is controlled in order to get engine brake effect.

Drawing Description Text (5):
FIG. 4 is a block diagram showing the brake system and the automatic transmission control system to which is applied the present invention.

Detailed Description Text (3):
The present invention will be described more specifically with reference to the accompanying drawings. First of all, here will be described the summary of a vehicle to which is directed the present embodiment. In FIG. 1, there is connected to the output side of an engine 1 acting as a power source, an automatic transmission 2, which is exemplified by transmission gear stages. The output power of the engine 1 is electrically controlled, and an intake manifold 3 of the engine 1 is provided with an electronic throttle valve 5, which is driven by a servo motor 4. The engine 1 is provided with a fuel injection control unit 6, including a fuel injector 6A, which controls the amount of the fuel injection in the combustion chamber 1A, and an ignition timing adjusting unit 7, including a spark plug 7A, a distributor 7B, and an ignition coil 7C. An opening amount of an acceleration pedal 8, which is used to control the output power of the engine 1, is detected by an

acceleration pedal switch 9. The acceleration pedal switch 9 generates a signal indicative of the operating amount of the acceleration pedal 8, which is applied to the engine electronic control unit (E-ECU) 10. The engine electronic control unit 10 is comprised of a micro computer, which incorporates a central processing unit CPU) 11, a random-access memory (RAM) 12, an input interface circuit 13, and an output interface circuit 14. The engine electronic control unit 10 is fed with various kinds of data to control the engine 1, for example, data from an engine revolving speed sensor 15 for detecting the revolving speed of the engine (Ne), data from an air flow meter 16 for detecting the quantity of intake-air (Q), an intake-air temperature sensor 17 for detecting the temperature of intake air, and a throttle sensor 18 for detecting the opening degree .THETA. of the electronic throttle valve 5. Furthermore, the engine electronic control unit 10 is fed with data from a vehicle speed sensor 19 for detecting vehicle velocity in accordance with the revolving speed of the output shaft of the automatic transmission 2 or the like, cooling water temperature sensor 20 for detecting the temperature of cooling water for the engine 1, and a brake switch 22 for detecting the amount of the operation of brake pedal 21. The engine electronic control unit (E ECU) 10 calculates the data, which are from various sensors and switches, in order to determine the driving condition of the vehicle. At least one of the following is controlled based on the driving condition: opening of the electronic throttle valve 5, the amount of the fuel injection of the fuel injection control unit 6, or the ignition timing of the ignition control unit 7. The engine electronic control unit (E-ECU) 10 and navigation systems are connected to communicate with each other to exchange data. It is possible that the engine electronic control unit (E-ECU) 10 controls at least one of the opening of the electronic throttle valve 5, the amount of the fuel injection of the fuel injection control unit 6, or the ignition timing of the ignition control unit 7 based on the route data output from the navigation system, which indicates the route that the vehicle will follow. So the engine electronic control unit (E-ECU) 10 stores the standard data, which will be corrected by correspondence of the road information to the route, to control the opening of the electronic throttle valve 5, the amount of the fuel injection of the fuel injection control unit 6, or the ignition timing of the ignition control unit 7.

Detailed Description Text (11):
A hydraulic control device 54 is used to achieve the gear stage or shift change of the automatic transmission 2, to engage or release a lock up clutch 30, line pressure of the oil, and oil pressure for the engaging the frictional engagement unit. The hydraulic control device is controlled by the transmission control unit 55. It has three solenoids, S1, S2, and S3 for shifting the gear stage of the automatic transmission 2 and one solenoid, S4, for establishing an engine braking effect. It has three linear solenoids, a first one is SLT for producing a line oil pressure of an oil circuit, a second one is SLN for controlling an accumulator back pressure of aa--during the shift changing of the automatic transmission 2, and a third one is SLU for controlling the oil pressure of the lockup clutch and specific frictional engagement units.

Detailed Description Text (12):
Control signals are sent from the transmission electronic control unit (T-ECU) 55 to the hydraulic control device 54. The gear stage of the automatic transmission 2, producing the line oil pressure of an oil circuit, and controlling the accumulator back pressure, is controlled on the basis of the signals. The shifting control unit is mainly of a microcomputer, which incorporates a central processing unit (CPU) 56, memories (RAM, ROM) 57, an input-interface circuit 58, and an out-put interface circuit 59. The transmission electronic control unit 55 receives data for controlling the automatic transmission 2, for example, from the throttle sensor 18, from the vehicle speed sensor 19, from the engine cooling water temperature sensor 20, from the brake switch 22, from the operation position sensor 60 for detecting the operated position of the shift lever which is manually operated, from a shift pattern select switch for selecting the shift patterns, which the automatic

transmission 2 obey, from an overdrive switch 62, from an input shaft revolving sensor for detecting the revolving speed of the frictional engagement unit C0, and from an oil temperature sensor 64 for detecting the oil temperature in the automatic transmission 2.

Detailed Description Text (13):
The transmission electronic control unit (T-ECT) 55 and the engine electronic control unit (E-ECU) 10 are connected to communicate with each other, the engine electronic control unit 10 sends signals, for example, the quantity of intake air per cycle (Q/Ne) and the transmission electronic control unit 55 sends signals, for example, the equivalent signal for controlling the solenoids and the signals that indicates the gear stage which the automatic transmission 2 selects.

Detailed Description Text (15):
The transmission electronic control unit (E-ECT) 55 and a navigation system which will be explained lately, are connected to communicate with each other. The navigation system sends signals, for example, the data about the route. The transmission electronic control unit (E-ECT) 55 controls the automatic transmission 2 on the basis of the signals from the navigation system. The transmission electronic control unit 55 stores the standard data and the procedures of the calculations in order to control the automatic transmission 2 in accordance with the condition of the route.

Detailed Description Text (16):
The transmission electronic control unit 55 outputs indication signals for the automatic transmission 2 on the basis of the signals from the various sensors and switches. It determines if there is a failure in the various solenoids based on the signals from the various sensors and switches. Preparing for the failure, the transmission has a fail safe function to control the automatic transmission 2 safely without preventing operating of the vehicle.

Detailed Description Text (18):
The brake system 65 and the navigation system 67 are connected to communicate with each other. It is possible to adapt the braking force by controlling the oil pressure to the wheel cylinder 69 on the basis of the information about the route detected by the navigation system 67. The electronic control system 72 stores the standard data and the procedures of the calculations in order to control the automatic transmission 2 in accordance with the condition of the route.

Detailed Description Text (19):
The vehicle auto drive control system 66 controls the engine 1 and the automatic transmission 2 in order to control the vehicle speed automatically. The vehicle auto drive control system 66 has a control switch 73 for setting the vehicle speed, a cancellation switch 74 for canceling the vehicle auto drive control, a vehicle speed sensor 19 for detecting the vehicle speed, an electrically controlled throttle valve 5 provided in the intake manifold 3 of the engine 1, an electronic throttle valve 5 which is driven by an servo motor 4, and an electrical control system 75 for controlling these elements on the basis of the selected vehicle speed and the driving condition of the vehicle. An operation signal from the control switch 73 of the vehicle auto drive control system 66 is sent to the engine electronic control unit (E-ECT) 10 and the transmission electronic control unit (T-ECT) 55. These units control the amount of the opening of the electronic throttle valve 5 at the specific condition and the gear stage without the operation of the acceleration pedal 8. Consequently the speed of the vehicle is fixed. The vehicle auto drive control system 66 cancels the automatic speed control by detecting at least one of the operations, acceleration pedal 8 movement, brake pedal 21 movement, or shift lever 53 movement of the automatic transmission 2. The vehicle auto drive control system 66 and the navigation system 67, which will be explained later, are connected to communicate with each other. The navigation system 67 sends signals, for example, the data about the route. It is possible to start or cancel

the automatic speed control on the basis of the information on the route from the navigation system 67. The electronic control system 75 stores the standard data and the procedures of the calculations in order to control the vehicle auto drive control system 66 in accordance with the condition of the route.

Detailed Description Text (21):
The electronic control unit 76 is a microcomputer which include a central processing unit (CPU), a memory unit (RAM and ROM 83, input interface 84, and output interface 85. The player 79 is used for reading out data which is stored in a data recording medium 86, for example, an optical disk or a magnetic disk. The data recording medium 86 stores not only the data necessary for driving the vehicle, for example, place names, roads or main buildings along the roads but also specific road situations, for example, straight roads, curves, up slopes, down slopes gravel roads, sandy beaches, riverbeds, urban areas, mountain regions, ordinary roads, expressways, rivers, seas, paved or unpaved roads, rough or smooth roads, road signs, and traffic regulations.

Detailed Description Text (24):
The first data detecting unit 22 is equipped with a slope sensor for detecting the slopes of roads, a video camera 93 for recognizing a front vehicle and detecting the distance therefrom, a laser cruise unit 94, a distance sensor 95, a wheel speed sensor 96 for detecting the rotational speeds of the individual wheels separately, an acceleration sensor 97 for detecting the acceleration of the vehicle in all directions and a vehicle speed sensor 19 for detecting the revolving speed of the output shaft of the transmission. Here, the laser cruise unit 94 controls the throttle opening to keep a set vehicle speed when the front vehicle is not detected by the laser radar or when the distance from the front vehicle is sufficiently large.

Detailed Description Text (25):
The first data detecting unit 22 and the electronic control unit 76 are connected to transmit the data so that the data, as detected by the first data detecting unit 22, is transferred to the electronic control unit 76. The second data detecting unit 23 detects the present position of its vehicle, the road situations, other vehicles, blocks and the weather, and is composed of a GPS antenna 99 for receiving radio waves from a man-made satellite 98, an amplifier 100 connected with the GPS antenna 99, and a GPS receiver 101 connected with the amplifier 100. The second data detecting unit 23 is equipped with an antenna 103 for receiving radio waves from a ground data transmission system 102 such as a transmitter carried on another vehicle, a beacon or sign post disposed on the road side, a VICS (Vehicle Information & Communication System) or an SSVS (Super Smart Vehicle System), an amplifier 104 connected with the antenna 103, and a ground data receiver 105 connected with the amplifier 45.

Detailed Description Text (26):
The GPS receiver 101 and the ground data receiver 105 are so connected with the electronic control unit 76 as to effect the data communications. The data, as detected by the second data detecting unit, are transferred to the electronic control unit 76.

Detailed Description Text (27):
The multiple audio visual system 80 has a display 106 which consists of a liquid crystal display or a cathode-ray tube (CRT) and various switches. The multiple audio visual system 80 displays the data graphically, for example, the road to follow to the destination, the road situations of the roads, the present position of the vehicle, the presence and location of other vehicles, or the presence and location of blocks, and displays the operating modes corresponding to the predetermined sections of the road situations and the shift diagrams to be used for controlling the automatic transmission 2 on the basis of the data stored in the data recording medium 86 or first and second data detecting unit 77 and 78.

Incidentally, the various data are displayed in the display 106 and outputted as voices from the speaker 81.

Detailed Description Text (28):
With the multiple audio visual system 80, there are connected a various switches 107, which can be operated to control the first detecting unit 77 or the second data detecting unit 23, to set the destination and the road to follow, to set or change the predetermined sections in the roads, to enlarge or reduce the size of the map, and to display and change the shift map to be applied for controlling the automatic transmission 2.

Detailed Description Text (31):
The followings are examples; the automatic transmission 2 which has plural and non-continuous gear stages are controlled on the basis of data about the condition of the route detected by the navigation system 67.

Detailed Description Text (33):
In FIG. 7, the navigation system 67 or the transmission control unit 55 detects not only an immediate vehicle speed decreasing point, at which it is necessary to decrease the speed of the vehicle, but also the vehicle speed decreasing point within the predetermined distance place. And it determines whether the decrease in the speed needs to be more than the threshold or not at each place. And this determination is used for the control of the automatic transmission 2. First of all, the driver's operation for the setting of the destination and the indication of the map of the route is executed by using the switches 107 of the multiple audio visual system 80. The present position of the vehicle and the road ahead of the present position can be specified by the data of the first data detecting unit 22 and the second data detecting unit 23.

Detailed Description Text (43):
At Step 10, if the criteria for the shift down of the automatic transmission 2 are satisfied, more than one gear stage of the shift down will be executed and the control flow returns. The criteria for the shift down include following condition, when the amount of the operation of the brake pedal 21 is detected, or when the amount of the operation of the acceleration pedal 8 is detected. The number of the shift at the same time is determined on the basis of the deceleration which is needed.

Detailed Description Text (46):
In other words, if the deceleration is smaller than the threshold value, the shift down is prohibited. It is possible to decrease the number of the shift down of the automatic transmission 2 as small as possible. Comfort and drivability of the vehicle will be improved because the shift down of the automatic transmission 2 is controlled. As shown in FIG. 7, because the shift down of the automatic transmission 2 is controlled by taking account into the corners, the shift down is prohibited during the corner, and the shift shock during the corner is controlled, and the handling of the vehicle is stable and stability of the operation is improved.

Detailed Description Text (72):
Instead of the control shown in FIG. 7, it is possible to adapt the following example. The control system has a vehicle speed decreasing point detector which detects only those places where it is necessary to decrease the vehicle speed. The vehicle target speed calculator calculates a vehicle target speed only for the vehicle speed decreasing point. And it has a target deceleration calculator which calculates the decrease speed to the vehicle target speed. And it has a gear stage controller which executes shift down of the automatic transmission 2 only if the decrease speed is more than the threshold.

Detailed Description Text (73):

It is possible for automatic transmission 2 to control other systems to decrease the vehicle speed. In such a case, the information about the corner detected by the navigation system 67, the distance between present position and the corner, and the radius of the corner are used for the control.

Detailed Description Text (82):
Furthermore, the automatic transmission 2 is controlled on the basis of the road conditions detected by the navigation system 67, if a diverging point, such as an intersection, is detected on the road ahead of the present position, it is impossible to predict which way the driver will choose. So control of the detecting the corners is stopped or control of the automatic transmission 2 is prohibited. As a result, it is possible to prevent disagreement between the road condition and the driving force of the vehicle, and improve the drivability. This invention is applicable to the automatic transmission which is capable of setting three forward gear stages or four forward gear stages. And this invention is applicable to the vehicle which is equipped an electronic motor as a power source.

Detailed Description Text (83):
In this invention, it is possible not to down shift if the deceleration is smaller than the threshold value. And this invention reduces the number of the transmission condition changes, for example, down shift, as possible as it can. So it is able to control the shift shock of the automatic transmission and improve the comfort of the vehicle and drivability. The invention prohibits a down shift during the corner, so it is improves the shift shock and the behavior of the vehicle and stability of the vehicle.

Current US Cross Reference Classification (7):
701/96

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Y+R

L10: Entry 2 of 10 File: USPT Sep 16, 2003

DOCUMENT-IDENTIFIER: US 6622079 B2
TITLE: Vehicle, and apparatus for and method of controlling traveling of the vehicle

Application Filing Date (1):
20020222

Brief Summary Text (6):
According to the prior art, when the driver has erroneously switched the vehicle into the mode to follow-up a vehicle in front at a point to turn into or off a highway or an intersecting point and if there is no vehicle traveling in front, the vehicle is accelerated so as to reach a preset target vehicle speed and this tends to annoy the driver or unavoidably cause an accident.

Drawing Description Text (4):
FIG. 3 is an explanatory drawing of an example of an area where control by headway distance is prohibited on a highway.

Detailed Description Text (6):
Now, control logic used when the driver wanted to change the traveling mode from the above described normal traveling mode to control by headway distance, by operating such a switch as the changing switch SW, will be described. When control by headway distance is requested, the relative velocity Vs between the vehicle and an object (vehicle or another) in front, headway distance St, target headway distance Stt, and the value No are input to a first target drive shaft torque calculation means 10 and a target acceleration/deceleration is calculated from the deviation between the value No and a target vehicle speed Vtt, which is calculated from the above values Vs, St, and Stt, and the time taken to reach the target vehicle speed, and, then, the first target value Ttar 1 is calculated from the vehicle weight, the tire radius, the acceleration of gravity, and the flat ground running resistance. Then, the value Ttar 1 is input as a parameter to a cut-in recognition means 11 and the changing means 1. For example, when the vehicle is safely following up a vehicle ahead, control of driving force at the time of normal traveling is exercised according to the value Ttar 1. On the other hand, in an emergency of another vehicle cutting in in front of the vehicle, the abrupt change of the Ttar 1 is recognized by the cut-in recognition means 11 and the mode is to automatically changed to the mode of control by headway distance. Thus, safety vehicle follow-up control can be realized.

Detailed Description Text (9):
First, the above No is input to a traveled distance calculation means 30 and the traveled distance l is calculated with a function f. In addition, an angular velocity .omega. is input to a direction calculation means 31 and the direction d is calculated with a function g. Accurate distance and direction from a GPS (Global Positioning System) 32 are respectively input to the distance calculating means 30 and the direction calculating means 31 to correct the above values l and d. Then, the values l and d, and, further, map information from a CD-ROM (Compact Disc-Read Only memory), which includes information about areas where control by headway distance is prohibited (FIG. 6), are input to a restricted area setting means 33. According to the signals, a traveling restricted area required for switching

between the first traveling mode the second traveling mode is calculated. The data of the restricted area is input to a first traveling mode prohibiting means 35 and a mode switching prohibiting means 36. For example, in control logic exercised when the vehicle shifts from a first running mode permitted area to the first running mode prohibited area (where only the second traveling mode is allowed) as shown in FIG. 7, the mode of control must be switched over prior to the shifting to the first running mode prohibited area. This means that the driver must be notified, before making the switching, of the need for switching the traveling mode by means of a transition notice means 37. After the notice has been given, the vehicle is run a preset period of time or a preset distance at a constant deceleration so that the driver is made ready for making manual driving operation. This control is such that allows the target value changing means 2 to select the value calculated in a target constant deceleration calculation means 38 by using the signal from the mode prohibiting means 35 as a trigger signal to thereby control the power train. Thereby, the traveling mode switching being safe and comfortable for the driver can be achieved. If the accelerator pedal is treaded during the deceleration period of time, it is judged that the manual running is made ready and at once the first traveling mode is turned off. Operation of the mode switching prohibiting means 36 will be described with reference to FIG. 8. The operating state here exemplifies a case where the vehicle traveling a first traveling mode permitted area enters a first traveling mode prohibited area immediately after the driver has operated the changing switch SW. In such a traveling state, the vehicle follow-up control is exercised according to the switch operation, but then, since the driver returns the accelerator pedal to its original position as indicated by the broken line, the degree of the throttle valve opening is reduced and the vehicle speed is decreased. Then since the driver hastily treads on the accelerator pedal, it gives an unpleasant feeling to the driver. Therefore, if the vehicle is going to shift into a first running mode prohibited area soon when the above switch has been operated, the switching to the first running mode is prohibited by the mode switching prohibiting means 36 as indicated by the solid line and simultaneously the driver is notified of the fact that the switching to the first running mode cannot be made by means of the above transition notice means 37. Now control exercised when the vehicle shifts from a first traveling mode prohibited area to a first traveling mode permitted area will be described with reference to FIG. 13 (a time chart in the case where the vehicle shifts from a first running mode prohibited area to a first running mode permitted area). First, the changing switch SW and the transition notifying flag are in an on state in the first traveling mode prohibited area (while the vehicle is traveling in the second traveling mode). The ON state of the switch indicates that the first traveling mode will start upon turning OFF of the transition notifying flag, namely, that control by headway distance will soon be exercised. If, in this state, the first traveling mode is permitted, namely, the transition notifying flag is turned off, there is the possibility that the vehicle is suddenly accelerated or decelerated. This is a dangerous thing and frightens the driver (the broken lines in FIG. 13). Therefore, it is designed so that the first traveling mode is executed when the transition notifying flag is off and the driver has operated the switch SW to turn it on again. Accordingly, as shown in FIG. 13, the degree of the throttle valve opening is controlled so that the vehicle following up is performed even if the driver operates the accelerator pedal. In addition, when the transition notifying flag is turned off, such a voice message as "Reset the changing switch because control by headway distance (the first traveling mode) is permitted" is issued to the driver.

Detailed Description Text (11):
FIG. 2 illustrates the system configuration of the invention. An engine 16 and a speed change gear 17 are mounted on a vehicle body 15, and an engine power train control unit 19 controls the driving horsepower transmitted to a power train between the engine 16 and wheels 18. The control unit 19 calculates the second target drive shaft torque (driving force, acceleration/deceleration), and according to the thus calculated target value, target throttle valve opening .theta.t (air flow rate), fuel quantity, ignition timing, brake pressure Bt, speed change ratio

It, and transmission control oil pressure PL are calculated. For fuel control, a currently prevailing inlet port injection type or a cylinder injection type which is good in controllability is used. On the vehicle body 15, a TV camera 20 for detecting outer conditions and an antenna 21 for detecting infrastructural information are mounted. The images taken by the TV camera 20 are input to an image processing unit 22 to undergo image processing, and such things as the road gradient, the corner radius of curvature, information from signal units, and a road sign are recognized. The recognized traveling environmental signals are input to an environment-responsive power train control unit 23. A radar system 24 of the FM-CW type or the like is installed on the vehicle body 15 in the front to detect a distance St to a vehicle or an object ahead and the velocity Vs relative to it. The antenna 21 is connected to an infrastructural information terminal device 25 to set the vehicle follow-up control prohibited area, i.e., the first traveling mode restricted area according to the infrastructural information. The area signal is input to a traveling mode determination unit 40 and the power train is controlled based on the result of the determination. In addition, information from infrastructure contributes to detection of road conditions ahead (wet, dry, snow-covered, or sandy) and information of a traffic snarl and, further, enables calculation of the friction coefficient .mu. between the tire and the road depending on the road conditions. The traveling environments can also be determined from the map information stored in the CD-ROM 26 and the like so that road conditions ahead (the road gradient, the radius of corner curvature, etc.) can be detected. Also, setting of a traveling restricted area in the first traveling mode is possible. The control unit 23 calculates the first target drive shaft torque (driving force, acceleration/deceleration) of the power train depending on the traveling environments that the vehicle encounters in the future and inputs the value to the control unit 19. The control unit 19 selects the first target value, the second target one, or the target value calculated by the unit 40 according to a signal from the changing switch SW operated by the driver. When the first target value is selected, the throttle valve opening .theta.t, fuel quantity, ignition timing, transmission control oil pressure PL, speed change ratio It, and brake force Bt are calculated based on the target drive shaft torque corresponding to the traveling environments. Further, into the control unit 19, such values as accelerator pedal angle .alpha., vehicle speed No, turbine number of speeds Ne, and angular velocity sensor signal .omega. are input. On the vehicle, a display 37, as the above-described transition notifying means, and the GPS 32 are mounted.

Detailed Description Text (12):
FIGS. 3 and 4 illustrates an example of the vehicle follow-up control prohibited area to which the invention is carried out. FIG. 3 shows exit/entrance of a highway, and FIG. 4 shows an intersection. The half-tone dot meshed zones are vehicle follow-up control prohibited areas. The prohibited areas may be specified by an infrastructure 50 on the road side shown in FIG. 4. In FIG. 3, the traveling restricted area set in the setting means 33 corresponds the vehicle follow-up control prohibited area, which is represented at least by three coordinate points (A, B, C). Thus, the upper half-tone dot meshed zone in FIG. 3 is specified by the combination of the triangular area ABC and the triangular area ACD. Of course, it may be specified by one square area ABCD. In the lower portion of FIG. 3, there is shown a complicated area specified by a combination of several triangular areas. Also in this case, one polygon may be used to specify the area.

Detailed Description Text (13):
FIG. 5 illustrates a method of recognizing a follow-up control prohibited area. The white circle indicates the point at which the own vehicle is present now, black circles indicate the points at which the own vehicle will arrive from now on, and the broken line indicates the course to be taken. At the point where the own vehicle is now present, a point in front is detected beforehand and it is determined whether or not the vehicle follow-up control is allowed there. To make the determination, the CD-ROM data shown in FIG. 6 is used. In the CD-ROM, there are stored a plurality of the points related to the road, and in each of the point,

there are stored the relevant road conditions. By having the areas in which control by headway distance is prohibited stored in some of them, control by headway distance can be restricted according to the road environments ahead of the vehicle and, thereby, safety during the control by distance between vehicle can be secured. Referring to FIG. 5, an infrastructure 51 is detecting the traveling environments, and if it is snowing at the next point (half-tone dot meshed area), a signal of existence of an area where the control by headway distance is prohibited is transmitted from the infrastructure 51. In this case, the signal of the prohibited area is sent to the rewrite means 41 and the traveling restricted area is set in storage means within the setting means 33. The setting of the traveling restricted area is carried out according to the above-described coordinate axes (oblique-lined portion). In this way, control by headway distance is prohibited on a slippery road. Where a road is slippery, i.e., the coefficient of friction between tires and the road surface is low, it is difficult to exercise the control by distance between vehicle because the acceleration/deceleration performance of a vehicle widely varies with such conditions as the tire groove shape, presence or absence of ABS (Antilock Brake System), and presence or absence of traction control. The invention allows control by headway distance to be prohibited on a slippery road and safety traveling to be secured. While the above description is about making a decision whether or not control by headway distance is prohibited according to changes in the road environments ahead, the control system can also change the traveling conditions according to the changes in the road environments. FIG. 10 shows data of target distances between vehicles when it is fine and FIG. 11 shows correcting coefficients of the headway distance when traveling environments are changed. In FIG. 10, the target headway distance Stt varies with the vehicle speed No. For low vehicle speeds in the range from 0 to the speed at the point A, the target headway distance is set at a constant value B. Considering the situation in following up a vehicle ahead in a traffic snarl, it is designed so that the vehicle follows a vehicle ahead with a constant distance therebetween to thereby secure safety driving and prevent the driver from being frightened in a traffic snarl. For car velocities higher than that at the point A, the target distance to a car ahead is increased with increase in the vehicle speed to keep a safety distance between the vehicles that corresponds to the vehicle speed. The target distance to a car ahead is set under the condition that it is fine and the road is paved, i.e., the coefficient of friction between the road and tires is the highest. However, since vehicle traveling environments change from time to time, it is essential to set the safety target headway distance according to the changes in the environments. In FIG. 11, the correcting coefficient K of a distance to a vehicle ahead is set according to traveling environments and the type of the vehicle. Items of possible environments include fine, rainy, snowy, presence of a vehicle encountering an accident, a descent, an ascent, a corner, and the like. Types of vehicles may be classified by weight, i.e., they may be classified by such types as a light car, an ordinary car, a truck, etc. If traveling in rainy is taken for example, since the coefficient of friction between a tire and a road surface in rainy is lower than that when it is fine, the target headway distance Stt, which is applicable in fine and used as a reference value, is multiplied by the above described correcting coefficient K so as to increase the target headway distance. Thereby, even if the degree of grip of the car ahead is greater than that of the own vehicle on the following side (which depends on the degree of wear of the tires, difference in the tire width, difference in the tire rubber quality, difference in the brake units: presence or absence of the ABS, etc.), it is made possible for the own vehicle to make deceleration safely when the vehicle in front decelerates. In snowy day, in which the coefficient of friction between a tire and a road surface is still lowered, the coefficient K is set at zero to stop control by headway distance. In a case where information about presence of a car encountering a traffic accident is received as infrastructural information from such a unit as a beacon, it is required to previously set the target headway distance at a higher value because it is quite possible that the car ahead abruptly decelerates. Since the decelerating performance of the own vehicle on the following side is lowered when it goes down a slope and deceleration of the vehicle ahead is increased when it goes up a slope,

it is necessary to previously set the target distance between the vehicles at a higher value. The above descriptions were made as to correction of the target headway distance related to each of independent traveling environments. In reality, however, these individual traveling environments are combined together. In such a case, all of the correcting coefficients K are multiplied together to set a safety target headway distance. Where a visible-light camera, whose performance is lowered at night, is used, a decrease in its performance at night can be compensated for by replacing the value of each K with a value given in the parentheses thereunder in FIG. 11.

Detailed Description Text (14):
FIG. 12 illustrates a case where the correcting coefficient of a target headway distance is changed according to configuration of the areas traveled. A solid line in FIG. 12 indicates a highway. In the area (A) where the road is substantially straight, the correcting coefficient K is set at as large a value as 1.2 to make the headway distance larger because the vehicle speed is high and little delay in traveling occurs even if another vehicle cuts in. Thereby, safety can be secured and the driver is given a sense of relief while the vehicle is driven at high speeds. In the gently curved area (B), the above mentioned target headway distance in fine is used. Further, in the sharply curved area (C), the vehicle travels at a medium speed and other vehicles may cut in one after another, resulting in a great delay in traveling, and therefore, it is required to make such a mode of control to shorten the headway distance. In this case, the correcting coefficient is set at a value less than 1 to exercise control to shorten the target distance to a vehicle ahead. However, this is somewhat problematic in terms of safety, and therefore, it is better that the setting to decrease the target distance to a car ahead is carried out by the driver. Otherwise, it is required to previously give the driver an audio message indicating that the vehicle will soon enter the C area. As special conditions to be considered other than those mentioned above, such as presence of a tunnel, presence of an urban district, being at nighttime, being at daytime, being at rush hours etc. can be mentioned. Of course, it is possible to set a correcting coefficient applicable to each area or time zone, the same as in the cases described above (for example, A: 0.8, B: 0.6 and C: 0.6 may be applied to a period of traffic snarl). Especially, detection of the daytime is possible from lights being ON/OFF and information about environmental conditions in rush hours can be obtained from infrastructure. In addition, an area traveled can be modified. Namely, taking the area C for example, the area traveled can be expanded from (C) to (C') in rush hours when traffic congestion tends to occur to thereby cope with other vehicles frequently cut in.

Current US Original Classification (1):
701/96

CLAIMS:

14. An own vehicle according to claim 1, characterized in that said area or information of said road is obtained from at least one of an image of a view in front, a navigator, or information received from outside.

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WEST Search History

Hide Items | Restore | Clear | Cancel

DATE: Tuesday, November 23, 2004

Hide?	Set Name	Query	Hit Count
		DB=EPAB,JPAB,DWPI; THES=ASSIGNEE; PLUR=YES; OP=OR	
☐	L20	L18 and (camera$ or imag$) and gps	7
☐	L19	L18 and (road$ with sign$) and (camera$ or imag$) and gps	0
☐	L18	(("self-control" or automat$) with control$) and gps and manual$	62
☐	L17	L16 and (road$ with sign$) and (camera$ or imag$) and gps	1
☐	L16	L11	246785
☐	L15	L12	1
☐	L14	L13	0
		DB=PGPB,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR	
☐	L13	L12 and manual$	49
☐	L12	L11 and (road$ with sign$) and (camera$ or imag$) and gps	86
☐	L11	=20030422	272104
		DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR	
☐	L10	L9 and manual$	10
☐	L9	L8 and gps	34
☐	L8	L5 and (express$ or highWay or "high-way")	73
☐	L7	L6 and l5	0
☐	L6	6249720.pn. or 6405132.pn. or 6577933.pn. or 5899956.pn.	4
☐	L5	L4 and (camera$ or imag$)	107
☐	L4	L3 and (road$ with sign$)	269
☐	L3	l1 and L2	1897
☐	L2	=20030422	237246
☐	L1	701/2,19,20,22-25,51,52,93,96,120-121,207,223.ccls.	4004

END OF SEARCH HISTORY

L10: Entry 2 of 10 File: USPT Sep 16, 2003

US-PAT-NO: 6622079
DOCUMENT-IDENTIFIER: US 6622079 B2

TITLE: Vehicle, and apparatus for and method of controlling traveling of the vehicle

DATE-ISSUED: September 16, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Minowa; Toshimichi	Mito			JP
Nakamura; Kozo	Hitachiohta			JP
Takenaga; Hiroshi	Tokai-mura			JP
Endo; Yoshinori	Mito			JP
Morizane; Hiroto	Hitachi			JP
Yoshikawa; Tokuji	Hitachi			JP
Nakamura; Mitsuru	Hitachinaka			JP
Komuro; Ryoichi	Hitachi			JP

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Hitachi, Ltd.	Tokyo			JP	03

APPL-NO: 10/ 079910 [PALM]
DATE FILED: February 22, 2002

PARENT-CASE:
This application is a continuation of application Ser. No. 09/463,743, filed Jan. 31, 2000, now U.S. Pat. No. 6,385,529, which is a 371 of PCT/JP98/05438, filed Dec. 2, 1998.

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	10-127060	May 11, 1998

INT-CL: [07] G06 F 7/00

US-CL-ISSUED: 701/96; 701/300
US-CL-CURRENT: 701/96; 701/300

FIELD-OF-SEARCH: 701/96, 701/93, 701/70, 701/300, 701/65, 701/111, 180/167, 180/168, 180/169, 180/170-178

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected | Search ALL | Clear

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
☐	5902345	May 1999	Minowa et al.	701/96
☐	6009368	December 1999	Labuhn et al.	701/96
☐	6044321	March 2000	Nakamura et al.	701/96
☐	6058347	May 2000	Yamamura et al.	701/96
☐	6385529	May 2002	Minowa et al.	701/96

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0 145 989	June 1985	EP	701/96
360019208	January 1985	JP	701/96

ART-UNIT: 3661

PRIMARY-EXAMINER: Camby; Richard M.

ATTY-AGENT-FIRM: Crowell & Moring LLP

ABSTRACT:

A method comprising a first traveling mode in which the traveling environment ahead is recognized and at least one of the engine, the speed change gear, and the brake is controlled on the basis of a signal representing the recognition and a second traveling mode in which at least one of the engine, the speed change gear, and the brake is controlled on the basis of a signal generated by operation of the driver, in which the second traveling mode is selected in an area where vehicle following-up control is difficult.

15 Claims, 13 Drawing figures

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L17: Entry 1 of 1 File: DWPI Sep 23, 2004

DERWENT-ACC-NO: 2001-259430
DERWENT-WEEK: 200462

TITLE: Automatic travel guiding device for vehicle, increases accuracy of locating current position of vehicle on road map

INVENTOR: HASHIMOTO, K; IIBOSHI, A ; NOZAKA, T ; TAKAHASHI, T

PATENT-ASSIGNEE: HONDA GIKEN KOGYO KK (HOND)

PRIORITY-DATA: 1995JP-0127002 (April 17, 1995)

Search Selected Search ALL Clear

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
DE 69633202 E	September 23, 2004		000	G05D001/02
EP 1076276 A1	February 14, 2001	E	017	G05D001/02
EP 1076276 B1	August 18, 2004	E	000	G05D001/02

DESIGNATED-STATES: DE FR GB DE FR GB

APPLICATION-DATA:

PUB-NO	APPL-DATE	APPL-NO	DESCRIPTOR
DE 69633202E	April 11, 1996	1996DE-0633202	
DE 69633202E	April 11, 1996	2000EP-0123158	
DE 69633202E		EP 1076276	Based on
EP 1076276A1	April 11, 1996	1996EP-0105723	Div ex
EP 1076276A1	April 11, 1996	2000EP-0123158	
EP 1076276A1		EP 738946	Div ex
EP 1076276B1	April 11, 1996	1996EP-0105723	Div ex
EP 1076276B1	April 11, 1996	2000EP-0123158	
EP 1076276B1		EP 738946	Div ex

INT-CL (IPC): G01 C 21/28; G05 D 1/02

RELATED-ACC-NO: 1996-466869

ABSTRACTED-PUB-NO: EP 1076276A
BASIC-ABSTRACT:

NOVELTY - The device includes a navigation control portion (A) and an automatic travel control portion (B). The navigation control portion comprises a distance sensor (1) detecting a running distance of a vehicle, a direction sensor (2) detecting a running direction of the vehicle, a Global Positioning System (GPS) receiver (15), and a navigation signal processing portion (3). The latter consists of a computer system which determines a position of the vehicle every unit of time on the basis of GPS signals received by the GPS receiver.

DETAILED DESCRIPTION - The navigation signal processing portion searches an optimal course between a start point and a target point preset on a road map by evaluating travel cost- related variables such as travelling distance and travelling time on the basis of digitized road map data read from the map storage medium (4). The automatic travel control portion B comprises a video-camera (8) attached to the vehicle.

USE - For guiding the vehicle to travel tracing a target travel course preset on a road map indicated on display screen.

ADVANTAGE - Increased accuracy of travel control according to road conditions obtained by sensing the object ahead of the vehicle.

DESCRIPTION OF DRAWING(S) - The drawing is a block diagram showing a structure of an automatic travel guiding device.

Distance sensor 1

Direction sensor 2

Navigation signal processing portion 3

Map storage medium 4

Video- camera 8

GPS 15

ABSTRACTED-PUB-NO: EP 1076276A
EQUIVALENT-ABSTRACTS:

CHOSEN-DRAWING: Dwg.1/9

DERWENT-CLASS: T01 T06 W02 W06 X22
EPI-CODES: T01-J06B1; T06-B01A; W02-F01E; W06-A03A5; W06-A04H1; X22-E06D; X22-J05A;

L20: Entry 2 of 7 File: EPAB Jan 30, 2002

PUB-NO: EP001176392A1
DOCUMENT-IDENTIFIER: EP 1176392 A1
TITLE: NAVIGATION DEVICE

PUBN-DATE: January 30, 2002

INVENTOR-INFORMATION:

NAME	COUNTRY
NAGASAKA, CHIKAO	JP
KUNIMATSU, Y	JP
NISHIKAWA, MASATO	JP
ISOGAI, TOSHIYUKI	JP

ASSIGNEE-INFORMATION:

NAME	COUNTRY
TOKAI RIKA CO LTD	JP

APPL-NO: EP00904085
APPL-DATE: February 22, 2000

PRIORITY-DATA: JP06043599A (March 8, 1999)

INT-CL (IPC): G01 C 21/26
EUR-CL (EPC): G01C021/26; G07C009/00

ABSTRACT:

CHG DATE=20020302 STATUS=O> An object of the present invention is to provide a navigation device that can automatically open/close an electric garage door by remote control without manual operation and that can prevent erroneous opening/closing of the electric garage door. A navigation device 10 can be connected to a wireless garage door opener transmitter 50. The navigation device 10 transmits an open signal to the wireless garage door opener transmitter 50 when a vehicle position calculated by a GPS receiver 24 and an orientation detected by a gyro sensor 40 are within a predetermined range that respectively includes a preset electric garage door open instruction position and orientation, and a vehicle speed detected by a vehicle speed sensor 38 is no greater than a predetermined value. Thus, erroneous opening of the electric garage door when the vehicle approaches the electric garage with an object other than entering the electric garage can be prevented. <IMAGE>

L20: Entry 3 of 7 File: EPAB Oct 20, 1994

PUB-NO: DE004325264C1
DOCUMENT-IDENTIFIER: DE 4325264 C1
TITLE: Method for handling the switching commands of manual switching operations in supply networks

PUBN-DATE: October 20, 1994

INVENTOR-INFORMATION:

NAME	COUNTRY
KUHNERT, EKKEHARD DR	DE

ASSIGNEE-INFORMATION:

NAME	COUNTRY
ATLAS ELEKTRONIK GMBH	DE

APPL-NO: DE04325264
APPL-DATE: July 28, 1993

PRIORITY-DATA: DE04325264A (July 28, 1993)

INT-CL (IPC): H02J 13/00; G01S 5/12; H04B 7/26
EUR-CL (EPC): G01S005/14; H02J013/00

ABSTRACT:

The invention relates to a method for handling the switching commands of manual switching operations in supply networks, managed by means of network control centres, for electricity, gas, water and the like. In the case of this method, for the purpose of fully automatic control of the entity authorised to switch during the handling of switching commands by the network control centre, the location of the entity authorised to switch is automatically determined on site, before carrying out the switching operation, by means of a GPS [global positioning system] receiver, incorporated in the entity authorised to switch, and communicated to the network control centre. This automatic, error-free and non-manipulable position identification of the entity authorised to switch by the network control centre forms the basis of an automatic identification of the switching device and enables the control of the entity authorised to switch without any intervention from the network control centre personnel, the automatic updating of the process image as well as simultaneous automatic logging in real time, solely by means of process software.

L20: Entry 4 of 7 File: DWPI Jun 17, 2003

DERWENT-ACC-NO: 2003-677730
DERWENT-WEEK: 200364

TITLE: Aircraft surveillance and recording system includes ground recording station that receives signals retransmitted from global positioning station and stores signals in ground station

INVENTOR: DONOVAN, D J; KERSTING, B C ; KOCHER, M P ; PAP, R M ; ROBINSON, T W

PATENT-ASSIGNEE: ACCURATE AUTOMATION CORP (ACCUN)

PRIORITY-DATA: 2000US-0532737 (March 22, 2000)

Search Selected Search ALL Clear

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
US 6580450 B1	June 17, 2003		005	H04N007/18

APPLICATION-DATA:

PUB-NO	APPL-DATE	APPL-NO	DESCRIPTOR
US 6580450B1	March 22, 2000	2000US-0532737	

INT-CL (IPC): H04 N 7/18

ABSTRACTED-PUB-NO: US 6580450B
BASIC-ABSTRACT:

NOVELTY - The output of the cameras (15,17,18) connected to pick-up images of instrument panel and crew before overwriting images, during short and long period of recordation. The signals from the loop recorders are controlled by the manual and automatic switches. A ground recording station receives the signals retransmitted from the global positioning satellite (GPS) (24) and stores the signals in the ground station.

USE - Aircraft surveillance and recording system.

ADVANTAGE - The signals produced by the cameras are recorded in the vehicle and transmitted to the active communication satellite from which it is then transmitted to a ground station, thus affording visual as well as acoustic data. By employing loop recorders, only portions of a trip is recorded and transmitted, thereby limiting untoward intrusions and overcome reluctance on portion of the crew of vehicle.

DESCRIPTION OF DRAWING(S) - The figure shows the block diagram of the aircraft

surveillance and recording system.

camera 11

video cameras 15

infrared cameras 17

external cameras 18

voice sensor 20

global positioning satellite device 24

ABSTRACTED-PUB-NO: US 6580450B
EQUIVALENT-ABSTRACTS:

CHOSEN-DRAWING: Dwg.1/1

DERWENT-CLASS: W02 W06
EPI-CODES: W02-C03B1A; W02-F01A5; W02-F01F; W06-B01B;

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L20: Entry 6 of 7 File: DWPI Jun 26, 2003

DERWENT-ACC-NO: 1998-568377
DERWENT-WEEK: 200350

TITLE: Robotic control system for path detection of agricultural harvester - has video cameras giving pair of images used to detect crop cutting path, obstacles and end of path to control harvester

INVENTOR: FITZPATRICK, K; HAPPOLD, M ; HOFFMAN, R ; PANGELS, H ; PILARSKI, T ; WHITTAKER, W ; OLLIS, M ; STENTZ, A

PATENT-ASSIGNEE: UNIV CARNEGIE MELLON (UYCAN)

PRIORITY-DATA: 1998US-079160P (March 24, 1998), 1997US-042003P (April 16, 1997), 1998US-0060179 (April 15, 1998), 2000US-0648741 (August 28, 2000)

Search Selected Search ALL Clear

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
DE 69814847 E	June 26, 2003		000	A01B069/00
WO 9846065 A1	October 22, 1998	E	059	A01D075/28
AU 9871106 A	November 11, 1998		000	A01D075/28
EP 975209 A1	February 2, 2000	E	000	A01D075/28
US 6336051 B1	January 1, 2002		000	G05B013/02
EP 975209 B1	May 21, 2003	E	000	A01B069/00

DESIGNATED-STATES: AU BR CA AT BE CH CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE DE DK FR GB IT DE DK FR GB IT

APPLICATION-DATA:

PUB-NO	APPL-DATE	APPL-NO	DESCRIPTOR
DE 69814847E	April 15, 1998	1998DE-0614847	
DE 69814847E	April 15, 1998	1998EP-0918120	
DE 69814847E	April 15, 1998	1998WO-US07314	
DE 69814847E		EP 975209	Based on
DE 69814847E		WO 9846065	Based on
WO 9846065A1	April 15, 1998	1998WO-US07314	
AU 9871106A	April 15, 1998	1998AU-0071106	
AU 9871106A		WO 9846065	Based on
EP 975209A1	April 15, 1998	1998EP-0918120	

EP 975209A1	April 15, 1998	1998WO-US07314	
EP 975209A1		WO 9846065	Based on
US 6336051B1	April 16, 1997	1997US-042003P	Provisional
US 6336051B1	March 24, 1998	1998US-079160P	Provisional
US 6336051B1	April 15, 1998	1998US-0060179	Cont of
US 6336051B1	August 28, 2000	2000US-0648741	
EP 975209B1	April 15, 1998	1998EP-0918120	
EP 975209B1	April 15, 1998	1998WO-US07314	
EP 975209B1		WO 9846065	Based on

INT-CL (IPC): A01 B 69/00; A01 D 75/28; G05 B 13/02; H04 N 7/00

ABSTRACTED-PUB-NO: US 6336051B
BASIC-ABSTRACT:

The agricultural harvester is provided with automatic steering and control. The harvester has a global positioning system (GPS) and inertial navigation system to provide location and orientation data. A field coverage planner (116) develops a steering plan for cutting a field. The harvester has a pair of video cameras mounted on either side to image the path ahead.

The video images are processed to detect (102) a crop line from the different colours of cut and uncut crop. The image is also used to detect (104) the end of a path and detect (110) obstacles. A steering arbiter (114) responds to the differing steering inputs to select a final path.

ADVANTAGE - Allows harvester to cut a field without manual supervision and reduces operator strain.

ABSTRACTED-PUB-NO: WO 9846065A
EQUIVALENT-ABSTRACTS:

The agricultural harvester is provided with automatic steering and control. The harvester has a global positioning system (GPS) and inertial navigation system to provide location and orientation data. A field coverage planner (116) develops a steering plan for cutting a field. The harvester has a pair of video cameras mounted on either side to image the path ahead.

The video images are processed to detect (102) a crop line from the different colours of cut and uncut crop. The image is also used to detect (104) the end of a path and detect (110) obstacles. A steering arbiter (114) responds to the differing steering inputs to select a final path.

ADVANTAGE - Allows harvester to cut a field without manual supervision and reduces operator strain.

CHOSEN-DRAWING: Dwg.5/13

DERWENT-CLASS: P11 P12 T04 T06 W06 X25
EPI-CODES: T04-D07D; T06-B01A; T06-D01A; W06-A03A5; X25-N01A;

L10: Entry 6 of 10 File: USPT Mar 6, 2001

US-PAT-NO: 6199001
DOCUMENT-IDENTIFIER: US 6199001 B1

TITLE: Control system for controlling the behavior of a vehicle based on accurately detected route information

DATE-ISSUED: March 6, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Ohta; Takashi	Kita-machi			JP
Iwatsuki; Kunihiro	Aichi			JP
Fukumura; Kagenori	Aichi			JP

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Toyota Jidosha Kabushiki Kaisha	Toyota			JP	03

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COUNTRY	APPL-NO	APPL-DATE
JP	8-354518	December 19, 1996
JP	8-355567	December 24, 1996

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FIELD-OF-SEARCH: 701/51, 701/54, 701/55, 701/65, 701/208, 701/209, 701/214, 701/216

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

Search Selected Search ALL Clear

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
5010490	April 1991	Nato et al.	364/426.04
5038880	August 1991	Matusoka et al.	180/179

☐	5128869	July 1992	Akishino et al.	701/97
☐	5146219	September 1992	Zechnall	340/995
☐	5148721	September 1992	Anan et al.	74/866
☐	5257188	October 1993	Sakakibara et al.	364/424.1
☐	5315295	May 1994	Fujii	340/936
☐	5485161	January 1996	Vaughn	342/357
☐	5504482	April 1996	Schreder	340/995
☐	5598335	January 1997	You	364/424.094
☐	5695020	December 1997	Nishimura	180/169
☐	5749063	May 1998	Sakonjyu et al.	701/93
☐	5771007	June 1998	Arai et al.	340/903
☐	5832400	November 1998	Takahashi et al.	701/53
☐	5835008	November 1998	Colemere, Jr.	340/439
☐	5839534	November 1998	Chakraborty et al.	180/169
☐	5884208	March 1999	Byon	701/110
☐	5890991	April 1999	Sakakiyama	477/48
☐	5893894	April 1999	Moroto et al.	701/53
☐	5902345	May 1999	Minowa et al.	701/96
☐	5913377	June 1999	Ota et al.	180/244
☐	5945799	August 1999	Shimizu	318/587
☐	5952939	September 1999	Nakazawa et al.	340/903
☐	6032098	February 2000	Takahashi et al.	701/210

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0 745 788	December 1996	EP	
0 752 548	January 1997	EP	
6-1353549	May 1994	JP	
7-306998	May 1994	JP	
5-262251	December 1994	JP	
7-85392	March 1995	JP	
8-72591	March 1996	JP	

ART-UNIT: 361

PRIMARY-EXAMINER: Zanelli; Michael J.

ATTY-AGENT-FIRM: Kenyon & Kenyon

ABSTRACT:

A control system for a vehicle includes a route information detector, which detects route information for the vehicle, and behavior control system, which is controlled by the route information detector and which controls the behavior of the vehicle. The control system also includes a means for detecting the accuracy of the detection of the route information, and a changing controller which changes the control of the behavior control system based on the accuracy of the detection of the route information. In this case, the behavior control system can be a transmission, a suspension system, a brake system, a steering system, an engine, or an auto drive control system. The behavior control system is controlled by control patterns that can be changed by a changing controller.

16 Claims, 23 Drawing figures

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L10: Entry 6 of 10 File: USPT Mar 6, 2001

DOCUMENT-IDENTIFIER: US 6199001 B1
TITLE: Control system for controlling the behavior of a vehicle based on accurately detected route information

Application Filing Date (1):
19971217

Brief Summary Text (5):
Generally a vehicle has a behavior control system, for example, an engine or a transmission. Control patterns applied to the behavior control system are either manually selected by the driver or automatically based on selected driving conditions detected by various sensors. But, both ways of selecting the control patterns are executed after encountering an actual vehicle condition change, hence behavior controls of the vehicle are delayed relative to actual road conditions, so it is possible to make the drivability of the vehicle worse.

Brief Summary Text (6):
Recently, it has become possible for a route information detection system, for example, a navigation system, to detect in advance information regarding the road conditions on which the vehicle travels, and this information is used to control the control patterns which are applied to the engine and automatic transmission in order to control the behavior of the vehicle as desired. An example of a vehicle control system is disclosed in Japanese Laid Open Publication No. HEI 8-72591.

Brief Summary Text (7):
In the above mentioned application, the vehicle control system for a vehicle has a location detection means, which detects the present location of the vehicle, a operating road predicting means, which predicts the future location of the vehicle in a few seconds later by referring to an electronic map, a running resistance measuring means, which measures the present load condition of driving systems of the vehicle, a driving force predicting means, which predicts the driving force at the predicted future location of the vehicle by correcting the present load condition on the basis of slope information from the electronic map, a driving system control unit, which controls in advance either the engine or the automatic transmission in order to get sufficient driving force of the predicted driving force to correspond and furthermore to reduce fuel consumption as much as possible, and a running locus recording means, which detects the information on the vehicle speed, and records and accumulates this information in the electronic map.

Brief Summary Text (8):
According to the above mentioned control system, by controlling the engine or the automatic transmission to get a predicted driving force, which corresponds to the condition of future location of the vehicle, and which is determined by the driving force predicting means, the vehicle is able to maintain the appropriate driving force for the road condition. Furthermore, it improves the drivability on an actual road condition by reflecting the driver's intention to the control of the driving force.

Brief Summary Text (12):
But in the control system for the vehicle, disclosed in the HEI 5-262251, the

control rules for the moving condition control means are automatically changed on the basis of whether the information, which is normal or fail. So, if the information output means deteriorates and consequently, the accuracy of the information is bad, and as the moving condition control is executed based on either the normal rule or the failure rule, it is difficult to meet the actual situation.

Brief Summary Text (16):
At least one of the following changes the control patterns which are applied to the control of the behavior control system corresponding to the accuracy of the route information; according to the accuracy of corner information, the automatic transmission is down shifted; according to the accuracy of down slope information, the automatic transmission is prohibited from shifting up; according to the accuracy of climbing road information, the automatic transmission changes its shift pattern of the shift diagram to the power pattern; according to the accuracy of down slope information, the brake system is controlled by its oil pressure; according to the accuracy of congestion information, the vehicle auto drive control is canceled or initiated; according to the accuracy of the surface condition of the road, the damping force of the suspension is changed; according to the accuracy of the surface condition of the road, the power assist of the steering wheel is changed; according to the accuracy of congestion, the engine is controlled to decrease its fuel consumption.

Drawing Description Text (5):
FIG. 4 is a one of the shift boundary lines, which is applied to the shift control of the automatic transmission disclosed in FIG. 1 and FIG. 2.

Detailed Description Text (2):
The entire disclosure of Japanese Patent Application HEI 8-354518 filed on Dec. 19, 1996 and HEI 8-355567 filed on Dec. 24, 1996 including specification, claims drawings and summary are incorporated herein by reference in their entirety. The present invention will be described more specifically with reference to the accompanying drawings. First of all, here will be described the summary of a vehicle to which is directed the present embodiment. In FIG. 1, there is connected to the output side of an engine 1 acting as a power source, an automatic transmission 2, which is exemplified by transmission gear stages. The output power of the engine 1 is electrically controlled, and an intake manifold 3 of the engine 1 is provided with an electronic throttle valve 5, which is driven by a servo motor 4. The engine 1 is provided with a fuel injection control unit 6, including a fuel injector 6A, which controls the amount of the fuel injection in the combustion chamber 1A, and an ignition timing adjusting unit 7, including a spark plug 7A, a distributor 7B, and an ignition coil 7C. An opening amount of an acceleration pedal 8, which is used to control the output power of the engine 1, is detected by an acceleration pedal switch 9. The acceleration pedal switch 9 generates a signal indicative of the operating amount of the acceleration pedal 8, which is applied to the engine electronic control unit (E-ECU) 10. The engine electronic control unit 10 is comprised of a micro computer, which incorporates a central processing unit CPU) 11, a random-access memory (RAM) 12, an input interface circuit 13, and an output interface circuit 14. The engine electronic control unit 10 is fed with various kinds of data to control the engine 1, for example, data from an engine revolving speed sensor 15 for detecting the revolving speed of the engine (Ne), data from an air flow meter 16 for detecting the quantity of intake-air (Q), an intake-air temperature sensor 17 for detecting the temperature of intake air, and a throttle sensor 18 for detecting the opening degree.THETA. of the electronic throttle valve 5. Furthermore, the engine electronic control unit 10 is fed with data from a vehicle speed sensor 19 for detecting vehicle velocity in accordance with the revolving speed of the output shaft of the automatic transmission 2 or the like, cooling water temperature sensor 20 for detecting the temperature of cooling water for the engine 1, and a brake switch 22 for detecting the amount of the operation of brake pedal 21. The engine electronic control unit (E-ECU) 10 calculates data, which are from various sensors and switches, in order to determine

the operating condition of the vehicle. At least one of the following is controlled based on the operating condition: opening of the electronic throttle valve 5, the amount of the fuel injection of the fuel injection control unit 6, or the ignition timing of the ignition control unit 7. The engine electronic control unit (E-ECU) 10 and navigation systems are connected to communicate with each other to exchange data. It is possible that the engine electronic control unit (E-ECU) 10 controls at least one of the opening of the electronic throttle valve 5, the amount of the fuel injection of the fuel injection control unit 6, or the ignition timing of the ignition control unit 7 based on the route data output from the navigation system, which indicates the route that the vehicle will follow. So the engine electronic control unit (E-ECU) 10 stores the standard data, which will be corrected by correspondence of the road information to the route, to control the opening of the electronic throttle valve 5, the amount of the fuel injection of the fuel injection control unit 6, or the ignition timing of the ignition control unit 7.

Detailed Description Text (9):
A hydraulic control device 54 is used to achieve the gear stage or shift change of the automatic transmission 2, to engage or release a lock up clutch 30, line pressure of the oil, and oil pressure for the engaging the frictional engagement unit. The hydraulic control device is controlled by the transmission control unit 55. It has three solenoids, S1, S2, and S3 for shifting the gear stage of the automatic transmission 2 and one solenoid, S4, for establishing an engine braking effect. It has three linear solenoids, a first one is SLT for producing a line oil pressure of an oil circuit, a second one is SLN for controlling an accumulator back pressure of an accumulator during the shift changing of the automatic transmission 2, and a third one is SLU for controlling the oil pressure of the lock-up clutch and specific frictional engagement units.

Detailed Description Text (10):
Control signals are sent from the transmission electronic control unit (T-ECU) 55 to the hydraulic control device 54. The gear stage of the automatic transmission 2, producing the line oil pressure of an oil circuit, and controlling the accumulator back pressure, is controlled on the basis of the signals. The shifting control unit is mainly of a microcomputer, which incorporates a central processing unit (CPU) 56, memories (RAM, ROM) 57, an input-interface circuit 58, and an out-put interface circuit 59. The transmission electronic control unit 55 receives data for controlling the automatic transmission 2, for example, from the throttle sensor 18, from the vehicle speed sensor 19, from the engine cooling water temperature sensor 20, from the brake switch 22, from the operation position sensor 60 for detecting the operated position of the shift lever which is manually operated, from a shift pattern select switch for selecting the shift patterns, which the automatic transmission 2 obeys, from an overdrive switch 62, from an input shaft revolving sensor for detecting the revolving speed of the frictional engagement unit CO, and from an oil temperature sensor 64 for detecting the oil temperature in the automatic transmission 2.

Detailed Description Text (11):
The transmission electronic control unit (T-ECT) 55 and the engine electronic control unit (E-ECU) 10 are connected to communicate with each other; the engine electronic control unit 10 sends signals, for example, the quantity of intake air per cycle (Q/Ne) and the transmission electronic control unit 55 sends signals, for example, the equivalent signal for controlling the solenoids and the signals that indicate the gear stage that the automatic transmission 2 selects. The transmission electronic control unit 55 determines the operating condition of the vehicle on the basis of the signals from various sensors and switches. It compares the operating condition and a shift diagram (or a shift map) in which the individual gear regions of forward stages are set by adopting the vehicle speed and the throttle opening, as parameters. By using the result of this comparison, it controls the gear stage, the engagement or release of the lockup clutch, the line pressure of the oil circuit, and the degree of the oil pressure of the engagement for the frictional

engagement units.

Detailed Description Text (12):
The transmission electronic control unit (E-ECT) 55 and a navigation system which will be explained lately, are connected to communicate with each other. The navigation system sends signals, for example, data about the operating route. The transmission electronic control unit (E-ECT) 55 controls the automatic transmission 2 on the basis of the signals from the navigation system. The transmission electronic control unit 55 stores the standard data and the procedures of the calculations in order to control the automatic transmission 2 in accordance with the condition of the operating route.

Detailed Description Text (13):
The transmission electronic control unit 55 outputs indication signals for the automatic transmission 2 on the basis of the signals from the various sensors and switches. It determines if there is a failure in the various solenoids based on the signals from the various sensors and switches. Preparing for the failure, the transmission has a fail safe function to control the automatic transmission 2 safely without preventing operating of the vehicle.

Detailed Description Text (14):
FIG. 4 shows an example of a map of shift boundary lines applied to the control of the automatic transmission 2. This map of the shift boundary lines are predetermined on the basis of a an operating speed V of the vehicle and the opening amount of the accelerate pedal. The example in FIG. 4 shows shift up boundary lines corresponding to the economy pattern, the normal pattern, and the power pattern. The shift boundary H1 of the economy pattern is set lower speed side of the shift boundary H2 of the normal pattern, the shift boundary H3 of the power pattern is set on the higher speed side of the shift boundary H2 of the normal pattern. Furthermore, it is possible to set the shift map for the snow pattern which always sets the second gear stage when the vehicle starts to go. The selection of the shift patterns is executed by the drivers operation of the select pattern switch 61. And it is possible to select the shift map automatically on the basis of route information which is detected by the navigation system. The means for selecting the shift map automatically incorporates the means for storing plural shift maps in the transmission electronic control units 55, the means for reading one of the shift maps, and the means for controlling the automatic transmission based on the selected map. It is possible to use the means for correcting the standard map by calculating on the basis of the information pattern, and to control the automatic transmission based on the corrected shift map.

Detailed Description Text (17):
The brake system 65 and the navigation system 70 are connected to communicate with each other. It is possible to adapt the braking force by controlling the oil pressure to the wheel cylinders 72 on the basis of the information about the operating route detected by the navigation system 70. The electronic control system 75 stores the standard data and the procedures of the calculations in order to control the automatic transmission 2 in accordance with the condition of the operating route.

Detailed Description Text (18):
The vehicle auto drive control system 66 controls the engine 1 and the automatic transmission 2 in order to control the vehicle speed automatically. The vehicle auto drive control system 66 has a control switch 76 for setting the vehicle speed, a cancellation switch 77 for canceling the vehicle auto drive control, a vehicle speed sensor 19 for detecting the vehicle speed, an electrically controlled throttle valve 5 provided in the intake manifold 3 of the engine 1, an electronic throttle valve 5 which is driven by an servo motor 4, and an electrical control system 75 for controlling these elements on the basis of the selected vehicle speed and the operating condition of the vehicle. An operation signal from the control

switch 76 of the vehicle auto drive control system 66 is sent to the engine electronic control unit (E-ECT) 10 and the transmission electronic control unit (T-ECT) 55. These units control the amount of the opening of the electronic throttle valve 5 at the specific condition and the gear stage without the operation of the acceleration pedal 8. Consequently the speed of the vehicle is fixed. The vehicle auto drive control system 66 cancels the automatic speed control by detecting at least one of the operations, acceleration pedal 8 movement, brake pedal 21 movement, or shift lever 53 movement of the automatic transmission 2. The vehicle auto drive control system 66 and the navigation system 70, which will be explained later, are connected to communicate with each other. The navigation system 70 sends signals, for example, data about the operating route. It is possible to start or cancel the automatic speed control on the basis of the information on the operating route from the navigation system 70. The electronic control system 78 stores the standard data and the procedures of the calculations in order to control the vehicle auto drive control system 66 in accordance with the condition of the operating route.

Detailed Description Text (23):
The lighting system 69 incorporates head lights 89, which are installed in the front part of the vehicle, tail lamps 90, which are installed in the back part of the vehicle, a light switch, which turns on or off the head lights 89 or the tail lamps 90 by the driver's operation, an illuminance sensor, which detects the illuminance around the vehicle and automatically turns on or off the head lights 89 or the tail lamps 90, a relay 93 which opens or shuts the electronic circuit connected to the head lights 89 or the tail lamps 90, and an control unit 94, which controls above mentioned elements.

Detailed Description Text (25):
The electronic control unit 95 is a microcomputer which includes a central processing unit (CPU), a memory unit (RAM and ROM) 83, input interface 84, and output interface 85. The player 79 is used for reading out data which is stored in a data recording medium 105, for example, an optical disk or a magnetic disk. The data recording medium 105 stores not only data necessary for driving the vehicle, for example, place names, roads or main buildings along the roads but also specific road situations, for example, straight roads, curves, up slopes, down slopes gravel roads, sandy beaches, riverbeds, urban areas, mountain regions, ordinary roads, expressways, rivers, seas, paved or unpaved roads, rough or smooth roads, road signs, and traffic regulations.

Detailed Description Text (28):
The first data detecting unit 96 is equipped with a slope sensor for detecting the slopes of roads, a video camera 110 for recognizing a front vehicle and detecting the distance therefrom, a laser cruise unit 111, a distance sensor 112, a wheel speed sensor 74 for detecting the rotational speeds of the individual wheels separately, an acceleration sensor 113 for detecting the acceleration of the vehicle in all directions and a vehicle speed sensor 19 for detecting the revolving speed of the output shaft of the transmission. Here, the laser cruise unit 111 controls the throttle opening to keep a set vehicle speed when the front vehicle is not detected by the laser radar or when the distance from the front vehicle is sufficiently large.

Detailed Description Text (29):
The first data detecting unit 96 and the electronic control unit 95 are connected to transmit data so that data, as detected by the first data detecting unit 96, is transferred to the electronic control unit 95. The second data detecting unit 97 detects the present position of its vehicle, the road situations, other vehicles, blocks and the weather, and is composed of a GPS antenna 115 for receiving radio waves from a man-made satellite 114, an amplifier 116 connected with the GPS antenna 115, and a GPS receiver 117 connected with the amplifier 116. The second data detecting unit 97 is equipped with an antenna 119 for receiving radio waves

from a ground data transmission system 118 such as a transmitter carried on another vehicle, a beacon or sign post disposed on the road side, a VICS (Vehicle Information & Communication System) or an SSVS (Super Smart Vehicle System), an amplifier 120 connected with the antenna 119, and a ground data receiver 121 connected with the amplifier 45.

Detailed Description Text (30):
The GPS receiver 117 and the ground data receiver 121 are so connected with the electronic control unit 95 as to effect data communications. Data, as detected by the second data detecting unit, are transferred to the electronic control unit 95.

Detailed Description Text (31):
The multiple audio visual system 99 has a display 122 which consists of a liquid crystal display or a cathode-ray tube (CRT) and various switches. The multiple audio visual system 99 displays data graphically, for example, the road to follow to the destination, the road situations of the roads, the present position of the vehicle, the presence and location of other vehicles, or the presence and location of blocks, and displays the operating modes corresponding to the predetermined sections of the road situations and the shift diagrams to be used for controlling the automatic transmission 2 on the basis of data stored in the data recording medium 105 or first and second data detecting unit 96 and 97. Incidentally, the various data are displayed in the display 106 and outputted as voices from the speaker 100.

Detailed Description Text (32):
With the multiple audio visual system 99, there are connected a various switches 107, which can be operated to control the first data detecting unit 96 or the second data detecting unit 97, to set the destination and the road to follow, to set or change the predetermined sections in the roads, to enlarge or reduce the size of the map, and to display and change the shift map to be applied for controlling the automatic transmission 2.

Detailed Description Text (47):
Examples of control flows disclosed in FIG. 9 diagnose the accuracy of the route information detected by the second data detecting unit 97 by itself. First of all, at Step 21, the received signals to the GPS receiver 117 determines whether they are in failure. This determination is executed based on the number of man-made satellites which send radio waves received by the receiver, and the receiving condition of the radio waves.

Detailed Description Text (48):
If the answer of the Step 21 is NO, the flow goes to Step 22, the navigation system 70 decides whether the vehicle is running at the inappropriate place for receiving the radio waves, for example, in a tunnel or between high buildings. If the answer of the Step 22 is NO, the control flow goes to Step 23, and the flag, which in the ON state indicates the accuracy of data received by the GPS receiver is bad, is turned OFF and the control flow returns. At Step 21 or 22, the answer is YES, the control flow goes to Step 24, and the flag, which in the ON state indicates the accuracy of data received by the GPS receiver is bad, is turned ON and the control flow returns. Steps 21, 22, 23, and 24 correspond to the means for detecting accuracy of the detection of the information.

Detailed Description Text (55):
Disclosed in FIG. 12 is the control of the automatic transmission 2 by the transmission electronic control unit 55, which basically shifts down when the navigation system 70 detects a corner in front of the vehicle.

Detailed Description Text (56):
At Step 51, it is decided whether the flag, which indicates the accuracy of the detection of the information about a corner detected by the navigation system 70,

is turned ON. If the answer of Step 51 is No, the control flow goes to Step 52, because the accuracy of detection of the route information by the navigation system 70 is better than predetermined degree, there is a corner, for example, an intersection where the vehicle will turn right or left. At Step 52 The automatic transmission 2 is automatically shifted down and the control flow returns.

Detailed Description Text (58):
If the answer of the Step 51 is YES, because there is no corner in front of the vehicle, the automatic transmission is not shifted down, and the control flow returns. Step 51 and 62 correspond to the means for detecting the accuracy of the detection of the information.

Detailed Description Text (59):
Disclosed in FIG. 13 is the other control example which changes the control pattern of the automatic transmission 2. Disclosed in FIG. 12 is the control of the automatic transmission 2 by the transmission electronic control unit 55, which basically prohibits from shifting up when a down slope is detected.

Detailed Description Text (60):
At Step 61, it is decided whether the flag, which indicates the accuracy of the detection of the information about the slope detected by the navigation system 70, is turned ON. If the answer of Step 61 is NO, the control flow goes to Step 62, because the accuracy of detection of the route information by the navigation system 70 is better than a predetermined degree, and there is a down slope in the road. At Step 62 The automatic transmission 2 is prohibited from controlling the shifting to a specific gear stage, in other words, shifting to the gear stage which has a smaller effect on the engine braking, or shifting up, and the control flow returns.

Detailed Description Text (62):
Example of control flows disclosed in FIG. 14 is the other control example which changes the control pattern of the automatic transmission 2. Example of control flows disclosed in FIG. 14 is the control of the automatic transmission 2 by transmission electronic control unit 55, which basically changes the shift pattern to the power pattern when the road requires an increase in the driving force, for example, a climbing road. They are detected by the navigation system 70.

Detailed Description Text (63):
Example of control flows disclosed in FIG. 13 is the other control example which changes the control pattern of the automatic transmission 2. Example of control flows disclosed in FIG. 12 is the control of the automatic transmission 2 by transmission electronic control unit 55, which basically prohibits shifting up when a down slope is detected.

Detailed Description Text (65):
The other control examples which change the control pattern of the automatic transmission 2 are the following. For example, Step 51 of FIG. 12 is substituted with the following step. It is decided whether the vehicle has reached the end of the congestion. So if the vehicle reaches the end of the congestion, the automatic transmission 2 is shifted to a specific gear stage, in other words, shifting to the gear stage which has more of an effect on the engine braking, shifting down. And another example, Step 52 is substituted with the following step, if the vehicle goes through the curve, the shift is prohibited. And there are other examples, which changes the control patterns of the automatic transmission. One is when the vehicle is stopping in the congestion, then the automatic transmission control system executes the neutral control which is for decreasing fuel consumption. The other one is when the vehicle is running on the freeway or in the suburbs, the automatic transmission control system chooses the economy pattern of the shift diagram. Yet another one is when the vehicle is running on the climbing road or down slope road, the automatic transmission control system prohibits shifting up to

the specific gear stage.

Detailed Description Text (81):
In the control that has the function of changing the degree of the control corresponding to the degree of the accuracy of the road condition, the accuracy of the detection of the information is classified and the multiple standards are predetermined corresponding to the multiple classifications of the information, and the different control which has different contents are executed. For example, the shift control of the automatic transmission has several threshold values which are used to determine when to shift, and these values correspond to the degree of the accuracy of the detection of the information. In this invention, the changing controller, in other words, the means for changing the control patterns that are applied to the control of the behavior control system, includes the function which corrects the standard control pattern by calculation and uses multiple control patterns that are predetermined. In this invention, it is possible to use the electronic motor as a drive force resource, to use continuously variable transmission (CVT) as a automatic transmission, and to use the manual transmission in stead of the automatic transmission.

Detailed Description Text (82):
In this specification, the behavior control system includes the engine 1, the automatic transmission 2, the servo motors 4, the electronic throttle valve 5, the fuel injection control system 6, the ignition timing adjusting unit 7, the hydraulic control device 54, the brake system 65, the vehicle auto drive control system 66, the suspension system 67, and the steering system 68. The route information detector includes the navigation system 70. The control system for the vehicle can control at least one of the behavior control systems on the basis of the route information by the navigation system. The control pattern of the behavior control system includes the following patterns.

Detailed Description Text (83):
When the vehicle goes through a curvy and winding road, the automatic transmission 2 is shifted down to reduce the vehicle speed by using the engine brake. When the vehicle starts on the road which has low frictional coefficient, the automatic transmission is set at the second gear stage in order to control the slip of the wheels. It is possible to prohibit a shifting down to smaller than the specific gear stages in order to control the slip of the wheels when the vehicle runs on a road which has a low frictional coefficient. It is possible to prohibit from shifting when the vehicle runs on a curve. It is possible to shift down when the vehicle reaches the end of a congestion, the automatic transmission 2 is shifted to a specific gear stage, in other words, shifting to the gear stage which has a larger effect on the engine braking, i.e., shifting down.

Detailed Description Text (85):
At the vehicle auto drive control system 66, when the vehicle runs on the freeway, it is possible to set vehicle speed automatically and start to control, and it also is possible to cancel the control of the vehicle auto drive control.

Detailed Description Text (93):
In FIG. 20, the navigation system 70 or the transmission control unit 55 detects not only an immediate vehicle speed decreasing point, at which it is necessary to decrease the speed of the vehicle, but also the vehicle speed decreasing point within the predetermined distance place. And it determines whether the decrease in the speed needs to be more than the threshold or not at each place. And this determination is used for the control of the automatic transmission 2. First of all, the driver's operation for the setting of the destination and the indication of the map of the operating route is executed by using the switches 107 of the multiple audio visual system 99. The present position of the vehicle and the road ahead of the present position can be specified by data of the first data detecting unit 96 and the second data detecting unit 97.

Detailed Description Text (104):
At Step 310, if the criteria for the shift down of the automatic transmission 2 are satisfied, more than one gear stage of the shift down will be executed and the control flow returns. The criteria for the shift down include following condition, when the amount of the operation of the brake pedal 21 is detected, or when the amount of the operation of the acceleration pedal 8 is detected. The number of the shift at the same time is determined on the basis of the deceleration which is needed.

Detailed Description Text (107):
In other words, if the deceleration is smaller than the threshold value, the shift down is prohibited. It is possible to decrease the number of the shift down of the automatic transmission 2 as small as possible. Comfort and drivability of the vehicle will be improved because the shift down of the automatic transmission 2 is controlled. As shown in FIG. 20, because the shift down of the automatic transmission 2 is controlled by taking account into the corners, the shift down is prohibited during the corner, and the shift shock during the corner is controlled, and the handling of the vehicle is stable and stability of the operation is improved.

Detailed Description Text (134):
Instead of the control shown in FIG. 20, it is possible to adapt the following example. The control system has a vehicle speed decreasing point detector which detects only these places where it is necessary to decrease the vehicle speed. The vehicle target speed calculator calculates a vehicle target speed only for the vehicle speed decreasing point. And it has a target deceleration calculator which calculates the decrease speed to the vehicle target speed. And it has a gear stage controller which executes shift down of the automatic transmission 2 only if the decrease speed is more than the threshold.

Detailed Description Text (135):
It is possible for automatic transmission 2 to control other systems to decrease the vehicle speed. In such a case, the information about the corner detected by the navigation system 70, the distance between present position and the corner, and the radius of the corner are used for the control.

Detailed Description Text (144):
Furthermore, the automatic transmission 2 is controlled on the basis of the road conditions detected by the navigation system 70, if a diverging point, such as an intersection, is detected on the road ahead of the present position, it is impossible to predict which way the driver will choose. So control of the detecting the corners is stopped or control of the automatic transmission 2 is prohibited. As a result, it is possible to prevent disagreement between the road condition and the driving force of the vehicle, and improve the drivability. This invention is applicable to the automatic transmission which is capable of setting three forward gear stages or four forward gear stages. And this invention is applicable to the vehicle which is equipped an electronic motor as a power source. In this invention, it is possible not to down shift if the deceleration is smaller than the threshold value. And this invention reduces the number of the transmission condition changes, for example, down shift, as possible as it can. So it is able to control the shift shock of the automatic transmission and improve the comfort of the vehicle and drivability. The invention prohibits a down shift during the corner, so it is improves the shift shock and the behavior of the vehicle and stability of the vehicle.

Current US Original Classification (1):
701/51

CLAIMS:

15. A control system for a vehicle, which has a route information detector which detects the location of the vehicle, and a behavior control system, which is controlled by the location detected by the route information detector, controls the behavior of the vehicle, said control system comprising:

means for calculating the location of the vehicle;

means for supplying position data;

means for determining the accuracy of the calculated location of the vehicle by comparing the calculated location of the vehicle and position data wherein the position data includes areas a GPS is inoperable; and

a controller which controls the behavior control system based on the accuracy of the calculated location of the vehicle.

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L10: Entry 9 of 10 File: USPT Jul 4, 2000

US-PAT-NO: 6085137
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TITLE: Vehicle control device

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U.S. PATENT DOCUMENTS

Search Selected Search ALL Clear

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
☐ 5893894	April 1999	Moroto et al.	701/53

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
51-22697	July 1976	JP	
62-292947	December 1987	JP	
5322591	December 1993	JP	
8159278	June 1996	JP	

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ATTY-AGENT-FIRM: Lorusso & Loud

ABSTRACT:

There is disclosed a vehicle control system that controls an automatic transmission by utilizing road information stored in a navigation system unit. In response to the road information stored in a data memory, the upper-limit of a shiftable gear ratio range is determined, thereby allowing change of the gear ratio only within the restricted range. The actual downshift is carried out in response to initiation of a decelerating operation by the driver, such as release of the accelerator pedal, which prevents unnecessary upshift and provides favorable transmission control in conformity with the driver's intention.

32 Claims, 16 Drawing figures

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Abstract Text (1):
There is disclosed a vehicle control system that controls an automatic transmission by utilizing road information stored in a navigation system unit. In response to the road information stored in a data memory, the upper-limit of a shiftable gear ratio range is determined, thereby allowing change of the gear ratio only within the restricted range. The actual downshift is carried out in response to initiation of a decelerating operation by the driver, such as release of the accelerator pedal, which prevents unnecessary upshift and provides favorable transmission control in conformity with the driver's intention.

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Brief Summary Text (18):
In another embodiment, the vehicle control system includes road information obtaining means for obtaining road information, current position sensor means for detecting the current position of the vehicle, an automatic transmission, recommended speed calculating means for calculating, in accordance with the road information, a recommended vehicle speed for passage of the vehicle through a specific position on the road, distance calculating means for calculating distance from the current position to the specific position, vehicle speed sensor means for detecting a current vehicle speed, reference speed calculating means for calculating a reference vehicle speed at the current vehicle position in accordance with the recommended vehicle speed and the calculated distance, decelerating operation sensor means for detecting that the driver has begun a

Brief Summary Text (24):
The vehicle control system may further include drive route searching means for searching to determine a travel route for the vehicle, and specific position means for determining position data for a specific position on the determined travel route from said road information obtaining means. Optionally, the system may also include goal set means for setting a goal wherein the drive route searching means determines a travel route to the goal when the goal has been set. The system may also set an imaginary drive route from the current position in the current vehicle direction when the goal has not yet been set. Another optional feature is a shift-position sensor which is mechanically or electrically connected to the automatic transmission for detecting shift position, whereby the primary and secondary upper-limit set means determining the primary and secondary upper-limits respectively in accordance with the detected drive shift position.

Detailed Description Text (3):
FIG. 1 shows vehicle control device 1 of this invention as including a navigation system 10, an automatic transmission 41, an A/T mode select unit 20 and a vehicle condition sensor 30. Navigation system 10 has a navigation processing unit 11, a data memory unit 12 that stores road information, a current position sensor 13, a communication unit 15, an input unit 16, a display unit 17, a voice input unit 18 and a voice output unit 19.

Detailed Description Text (6):
Among information stored in these files, the files respectively storing street crossing data, node data and road data are used in main for route searching in the navigation system. These files store data regarding road width, slope or gradient, road surface condition, radius of curvature, street crossings, T-shaped crossings, number of road lanes, lane merging points, entrance to the corner, railway crossings, exit ramps of expressways, tollgates, the points where road-width narrows, downhill grades, uphill grades, latitude and longitude absolute coordinates, altitude absolute coordinates, absolute position and altitude of nodes on roads, etc. Road information comprises the above-described data detected with regard to the current vehicle position, and comprises in main information for the road ahead of the current position in the driving direction. For example, such information includes street crossings positioned in advance on the travel route, corners, nodes and radii of curvature in predetermined section, distance from the current position to a predetermined point such as a street crossing or to a predetermined section, etc. The road information also includes various road conditions detected by respective sensors and obtained through communication means, etc.

Detailed Description Text (8):
Current position sensor 13 has a GPS receiver 131, a terrestrial magnetism sensor 132, a distance sensor 133, a steering sensor 134, a beacon sensor 135 and a gyro-magnetic sensor 136. GPS receiver 131 receives radio waves from earth satellites to determine the vehicle position. Terrestrial magnetism sensor 132 detects terrestrial magnetism to determine the direction in which the vehicle is advancing. Distance sensor 133 may be a measuring device of a type wherein the number of wheel rotations is detected followed by calculation or another type wherein acceleration is detected followed by double integration. Steering sensor 134 is typically an optical rotation sensor or a rotation-resistant volume mounted to a rotating steering member, but may be a steering angle sensor mounted to the wheel. Beacon sensor 135 receives positional information from beacons arranged beside the roads. Gyro-magnetic sensor 136 may be a gas-rate or vibration type gyro-magnetic sensor that detects a turning angle velocity of the vehicle followed by integration to determine the vehicle running direction.

Detailed Description Text (9):
GPS receiver 131 and beacon sensor 135 can be used alone to measure the vehicle position. Further, the absolute position of the vehicle may be determined by combination of a distance detected by distance sensor 133 and a direction detected by terrestrial magnetism sensor 132 and/or gyromagnetic sensor 136, or by combination of a distance detected by distance sensor 133 and a steering angle detected by steering sensor 134.

Detailed Description Text (22):
The above-described navigation processing unit 11 determines an upper limit for shiftable transmission speeds in response to the respective road information, whereby a command signal indicating the upper limit transmission speed is output to the automatic transmission to be described later.

Detailed Description Text (33):
The automatic transmission comprises a transmission mechanism 41 (referred to by A/T in the drawings) including a gear train composed in main of planetary gears and a hydraulic circuit for engagement and disengagement between components of the gear train to provide a multi-speed transmission, and an electric control circuit 40 (hereinafter referred to as "A/T ECU") for controlling the transmission mechanism unit 41.

Detailed Description Text (36):
The transmission maps have been prepared separately for a normal mode and a sport

mode, one of which is automatically selected in response to the transmission mode indicating signal supplied from navigation processing unit 11. The transmission mode may also be changed manually by the driver's operation of AT mode selecting unit 20.

Detailed Description Text (40):
When the shift lever is in the drive position, any one of 1st to 4th gear speeds in transmission can be selected. Either of the 1st and 2nd gear speeds is selectable in the second speed position. In the low speed position only 1st gear speed is applicable. In this embodiment, navigation system 10 performs the automatic transmission control operation when the shift lever is held at the drive position. When navigation system 11 commands that the upper limit for the transmission speeds is 3rd gear speed, the drive signal outputted therefrom ranges 1st to 3rd speeds, and is supplied to an actuator 42 that actually determines the gear ratio in response to the drive signal. For example, when A/T ECU 40 determines 4th gear speed but navigation system 11 commands that the transmission speed should be no higher than 3rd gear speed, a drive signal commanding 3rd gear speed is supplied.

Detailed Description Text (76):
For example, let us imagine that the vehicle goes through a turn or a curve. When the accelerator pedal is released at a point far ahead of the turn so that the vehicle enters the turn at a low speed, since there is no occurrence of any event in a predetermined control zone, the downshift control is not carried out in the above-described control routine. In this case, A/T ECU 40 controls the transmission speed in accordance with the normal transmission pattern. However, in the normal transmission control by A/T ECU 40, a downshift from 4th to 3rd is carried out at a vehicle speed much lower than that of an upshift from 3rd to 4th which is carried out after passing through the turn. This provides a smooth downshift feeling to the driver, but tends to delay the downshift timing so that sufficient acceleration can not be obtained during and after turning. To cope with this problem, this embodiment utilizes a transmission stand-by process that controls a downshift at an appropriate timing, when the vehicle enters the turn, even if no event (release of the accelerator pedal) has happened within the control zone.

Detailed Description Text (87):
In this embodiment, a direct downshift from 4th to 2nd is prohibited, irrespective of the optimum transmission speed determined by the control routine. This provides smooth deceleration. A downshift to 2nd is carried out in response to the driver's operation of stepping on the brake pedal, by which the driver's definite intention of deceleration is confirmed. Similarly, a downshift to 3rd is carried out in response to a release of the accelerator pedal, which is believed to represent the driver's intention of deceleration. When the driver releases the accelerator pedal, he or she does not want to speed up at that time. Accordingly, the driver would have no uncomfortable feeling when the transmission is automatically controlled to be downshifted, following his or her own operation of releasing the accelerator pedal.

Detailed Description Text (92):
The control operation by a navigation processing unit 11 and A/T ECU 40 in accordance with this embodiment will be described. In this embodiment, the transmission control operation begins when the vehicle reaches a point a predetermined distance ahead of a curve. More particularly, when the driver releases the accelerator pedal to decrease the throttle opening, the normal transmission control commands an upshift, but in accordance with the control in this embodiment, the transmission is automatically shifted down to increase engine braking, thereby lowering the vehicle speed and achieving smooth travel in the turn.

Detailed Description Text (103):
When the current shift position is a drive range (YES at S12a), navigation

processing unit 11 receives signals from an artificial satellite, through an antenna, using a GPS (Global Positioning System) to calculate the current vehicle position. It also reads out the road data from data memory 12a to recognize the current position on a map, and detects node points in the predetermined range that have been described with reference to FIG. 3 (at S14a). From the detected node points, it further determines if there is a turn on the scheduled travel route, and if there is a turn, detects a specific node point which is located at a peak of the turn (at S16a). By way of example, when there are three serial node points, and an angle of 170.degree. or smaller is defined between a first segment connecting first and second node points and a second segment connecting second and third node points, it is inferred that there is a turn. The "specific node point" is that defining the greatest angle between preceding and succeeding node-connecting segments among those constituting the turn. There may be plural specific node points in one turn. Step S16a is operation of the turn detection means.

Detailed Description Text (109):
Navigation processing unit 11 further operates to input the transmission speed that has been selected by A/T ECU 40 (at S27a), and compares this with a transmission speed that has been selected by itself (at S28a). When both have selected the same transmission speed (YES at S28a), which means that application of the inventive transmission control of this embodiment is not necessary, the procedure is advanced to step S37a where the flag of this turn-making transmission control operation is set to zero. In this case, the automatic transmission is controlled in a normal manner by using the transmission map. When, on the contrary, navigation processing unit 11 and A/T ECU 40 have selected different transmission speeds (NO at S28a), the turn-making transmission control of this embodiment continues as follows for restricting an upshift, depending upon the vehicle speed.

Detailed Description Text (118):
As described with reference to FIG. 7, navigation processing unit 11 executes a first upshift restricting control routine when the vehicle reaches a point a predetermined distance in advance of the peak point of the turn (the specific node point). In the example shown in FIG. 14, after the vehicle enters a first control zone where an upshift to 3rd is restricted (see FIG. 14(B)), the driver releases the accelerator pedal (see FIG. 14 (A)), whereby the transmission is automatically downshifted from 4th to 3rd, as shown in FIG. 14(D). This downshift provides a slowing of the vehicle by applying thereto a strong engine brake, as shown in FIG. 14(C). This downshift is carried out responsive to the driver's own operation of releasing the accelerator pedal, so that the driver does not have an uncomfortable feeling.

Detailed Description Text (122):
When the vehicle speed Vnow reaches the second upshift control speed at a time t2, in accordance with operation at S37a where the upper-limit command designating 3rd is cancelled. Up to this time, since A/T ECU 40 has already selected 4th speed in accordance with the transmission pattern of the normal transmission control, the transmission is automatically shifted up to 4th in quick response to cancellation of the upper-limit command of 3rd speed, at the time t2, as shown in FIG. 14(D).

Detailed Description Text (140):
As having been described, the present invention relates to the vehicle control device that is especially useful in automatic transmission control. In particular, this invention may be used in combination with a navigation system for automatic transmission control by utilizing road data and other data held in the navigation system.

Current US Original Classification (1):
701/51

CLAIMS:

1. A vehicle control device comprising road information obtaining means for obtaining road information, current position sensor means for detecting an on-road current position of a vehicle, an automatic transmission, optimum gear-ratio determining means for determining, in accordance with said road information, an optimum gear-ratio at which the vehicle could run from the current position detected by said current position sensor means through a specific forward position, decelerating operation sensor means for detecting that a driver begins decelerating operation, drive condition sensor means for detecting drive condition including a vehicle speed, primary upper-limit set means for determining said optimum gear-ratio determined by said optimum gear-ratio determining means as a primary upper-limit gear-ratio, in response to detection of initiation of the driver's decelerating operation by said decelerating operation sensor means, secondary upper-limit set means for determining a specific gear-ratio as a secondary upper-limit gear-ratio, independent of detection of initiation of said driver's decelerating operation, after determination of said primary upper-limit gear-ratio by said primary upper-limit set means, upper-limit gear-ratio determining means for comparing said primary and secondary upper-limit gear-ratios to select a lower one and outputting an upper-limit command designating said selected gear-ratio, and restriction means for restricting a shiftable range of said automatic transmission by setting said upper-limit gear-ratio designated by said upper-limit command.

2. A vehicle control device for controlling an automatic transmission having a shiftable range of gear ratios, said control device comprising:

road information obtaining means for obtaining road information for a road;

current position sensor means for detecting an on-road current position of the vehicle on the road;

optimum gear-ratio determining means for determining, in accordance with said road information, an optimum gear ratio for the vehicle in travel from the current position detected by said current position sensor means through a specific forward position in advance of the vehicle on the road;

decelerating operation sensor means for detecting start of a deceleration operation by a driver;

drive parameter sensor means for detecting at least one of driving parameters including vehicle speed;

primary upper-limit setting means for setting the optimum gear-ratio determined by said optimum gear ratio determining means as a primary upper-limit gear ratio, in response to detection of start of the driver's deceleration operation by said decelerating operation sensor means;

secondary upper-limit setting means for determining a specific gear ratio as a secondary upper-limit gear ratio, independent of detection of initiation of the driver's deceleration operation, after the setting of the primary upper-limit gear ratio by said primary upper-limit setting means;

upper-limit gear ratio determining means for comparing the set primary and secondary upper-limit gear ratios, for selecting the lower of said set primary and secondary upper-limit gear ratios and for outputting an upper-limit command designating the selected lower gear ratio; and

range restriction means for restricting the shiftable range of the automatic transmission to the upper-limit gear ratio designated by said upper-limit command.

12. A vehicle control device for controlling an automatic transmission having a

full shiftable range of gear ratios, said control device comprising:

road information obtaining means for obtaining road information for a road;

current position sensor means for detecting an on-road current position of the vehicle on the road;

recommended speed calculating means for calculating, in accordance with the road information, a recommended vehicle speed for a time at which the vehicle will pass through a specific position on the road;

distance calculating means for calculating a sectional distance from the current position to the specific position;

vehicle speed sensor means for detecting a current vehicle speed;

reference speed calculating means for calculating a reference vehicle speed at the current vehicle position in accordance with the recommended vehicle speed and the sectional distance;

decelerator operation sensor means for detecting start of a deceleration operation by a driver of the vehicle;

discrimination means for determining if the current vehicle speed exceeds the reference vehicle speed;

first restriction means for reducing the full shiftable range of gear ratios, responsive to detection of start of the driver's deceleration operation, when said discriminating means determines that the current vehicle speed exceeds the reference vehicle speed; and

second restriction means for determining a second restricted shiftable range of the gear ratios, in accordance with the detected current vehicle speed, regardless of detection of a deceleration operation.

13. A vehicle control device for controlling an automatic transmission having a full shiftable range of gear ratios, said control device comprising:

road information obtaining means for obtaining road information for a road;

current position sensor means for detecting an on-road current position of the vehicle on the road;

recommended speed calculating means for calculating, in accordance with the road information, a recommended vehicle speed for a time at which the vehicle will pass through a specific position on the road;

distance calculating means for calculating a sectional distance from the current position to the specific position;

vehicle speed sensor means for detecting a current vehicle speed;

reference speed calculating means for calculating a reference vehicle speed at the current vehicle position in accordance with the recommended vehicle speed and the sectional distance;

accelerator sensor means for detecting release of an accelerator;

discrimination means for determining if the current vehicle speed exceeds the reference vehicle speed;

upper-limit restriction means for lowering an upper-limit of the full shiftable range, responsive to detection of release of the accelerator by said accelerator sensor means, when said discriminating means determines that the current vehicle speed exceeds the reference vehicle speed; and

up-shift prohibiting means for prohibiting an up-shift from current transmission speed, when said discriminating means determines that the current vehicle speed exceeds the reference vehicle speed and release of the accelerator is not detected.

16. A vehicle control device for controlling a down-shift of an automatic transmission in response to a driver's operation indicative of an intent to decelerate, which comprises decelerating operation sensor means for detecting the driver's operation, and up-shift prohibiting means for prohibiting an up-shift in response to detection of said driver's operation.

28. The vehicle control device according to claim 25 which further comprises destination setting means for setting a destination and wherein said drive route searching means sets, as said scheduled drive route, a drive route to the destination when the destination has been set and an imaginary drive route from the current position in current vehicle direction when the destination has not been set.

29. The vehicle control device according to claim 2 further comprising shift-position sensor means, mechanically or electrically connected to the automatic transmission, for detecting current shift position, said primary and secondary upper-limit setting means determining the primary and second upper-limits respectively when said shift-position sensor means detects that said current shift position is a drive range position.

30. A vehicle control device for controlling an automatic transmission having a full shiftable range of gear ratios, said control device comprising:

current position sensor means for detecting an on-road current position of the vehicle on a road;

road information obtaining means for obtaining road information for the road;

curve sensor means for detecting a curve ahead of the current position in accordance with the road information;

down-shift means for commanding a down-shift as the vehicle approaches a predetermined position related to the curve;

passage discriminating means for determining when the vehicle has passed the predetermined position; and

up-shift restriction means for prohibiting an up-shift from current transmission speed until said passage discrimination means determines that the vehicle has passed the predetermined position, said up-shift restriction means allowing an up-shift from the current transmission speed at a higher vehicle speed than that dictating an up-shift in normal transmission control, after the vehicle has passed the predetermined position.

31. A vehicle control device for controlling an automatic transmission having a full shiftable range of gear ratios, said control device comprising:

current position sensor means for detecting an on-road current position of the vehicle on a road;

road information obtaining means for obtaining road information for the road;

curve sensor means for detecting a curve ahead of the current position in accordance with the road information;

down-shift means for commanding a down-shift as the vehicle approaches a predetermined position related to the curve;

passage discriminating means for determining when the vehicle has passed the predetermined position;

vehicle speed memory means for storing vehicle speed detected at a time when the vehicle passes the predetermined position; and

up-shift restriction means for prohibiting an up-shift from current transmission speed until said passage discriminating means determines that the vehicle has passed the predetermined position, and until the vehicle speed is detected to have increased to a predetermined speed that is higher than the vehicle speed detected at the time of passing the predetermined position.

32. A vehicle control device for controlling an automatic transmission having a full shiftable range of gear ratios, said control device comprising:

current position sensor means for detecting an on-road current position of the vehicle on a road;

road information obtaining means for obtaining road information for the road;

curve sensor means for detecting a curve ahead of the current position in accordance with the road information;

distance discriminating means for determining if the vehicle has overrun the predetermined position by a predetermined distance;

down-shift means for commanding a down-shift before the vehicle passes a predetermined position related to the curve; and

up-shift restriction means for prohibiting an up-shift from current transmission speed until said distance discriminating means has determined that the vehicle has overrun the determined position by the predetermined distance.

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